The State of Maryland's Coverage and Data Collection for the Nationwide Public Safety Broadband Network

Objective: The Nationwide Public Safety Broadband Network (NPSBN) promises to provide critical broadband data capability in the hands of first responders throughout the State of Maryland and nationwide. However, in order to serve its purpose, the Network must provide coverage in the areas where it is most needed by first responders. While it would be ideal to have immediate coverage in all areas of the country, FirstNet acknowledges that its limited budget of $7 billion allocated for the Network will necessitate a more gradual build out of the Network. Therefore, FirstNet has requested four data collection elements from the States that will provide relevant information to inform its Comprehensive Network Solution(s) Request for Proposal (RFP) and the State Network Plans that will be developed after the RFP is awarded.

The first element is the State's coverage objectives. FirstNet wants the States to identify desired coverage areas by developing their own baseline coverage objectives or by providing feedback on the FirstNet-developed baseline. FirstNet is also asking the States to plan a phased build-out approach and provide recommendations on targeted areas or objectives for each phase of a minimum five phase build out. More detail on this request will be discussed below.

The second element will document the State's users and their operations. FirstNet has requested information about the State's Public Safety Entities (PSEs), their devices, and their operational areas.

The third element will drive capacity planning. States are asked to gather information about Public Safety's application usage; frequency of use; and potential future use, as well as capturing and analyzing data that quantifies how much data is actually being used by a variety of PSEs.

The fourth element is current providers and procurement, asking for information about mobile data providers, plans, and costs.

The Maryland FirstNet team has determined that a coverage prioritization strategy is needed to analyze where broadband coverage is most needed in the State and to

propose build-out phases. A methodology to prioritize coverage based on specific need factors and historical data follows.

Survey Requests: Two surveys will be distributed to Public Safety agencies across the State. One survey will be sent to each of the 24 Public Safety Answering Points (PSAPs) to ask for fire, law enforcement, and emergency medical calls for service in each county. Due to the sensitive nature of the calls for service data, the data will be aggregated to a grid and summed over a one year time period to establish trends and to avoid reference to any specific incidences. This will provide the Maryland FirstNet team with data required for analysis, while maintaining anonymity of individual calls. The Eastern Shore Regional GIS Cooperative (ESRGC) at Salisbury University (SU) will receive, house, and process the calls for service data on SU's secure servers. The ESRGC has years of experience working with sensitive and confidential data and will not share or release the calls for service data to other parties. All calls for service data will be destroyed once the data has been processed and aggregated to a statewide grid. The data will be deleted from SU's secure servers after 60 days from delivery.

The other survey will ask public safety agencies about users and operational areas, devices, and providers and procurement. The answers provided from both surveys, as well as additional data from several additional sources, will be compiled and combined using a weighted algorithm to establish an overall "Public Safety Broadband Need" value. The "Public Safety Broadband Need" value will be used to prioritize the broadband coverage needs and establish a phased deployment plan for the NPSBN in Maryland.

Coverage Background: FirstNet has provided some guidance to the State as to how to develop coverage recommendations and how to discuss these with the FirstNet consultation team. Initially, the State was provided with baseline coverage recommendations from Homeland Security's Office of Emergency Communications (OEC), which was provided during the State's coverage workshop held in October of 2013. The data provided by OEC was based on population density and provided suggested levels of coverage in each county in the State based upon the following criteria:

- Metro areas with a population density greater than 1,000 people per square mile should be designed for In-Building Coverage with a handheld unit (Dark green in Figure 1).
- Areas outside of the large metros where the population density is less than 1,000 people per square mile but more than 500 people per square mile should be designed for Handheld Coverage/Partial In-Building (Green in Figure 1).
- Interstates and rural areas where the population density is at least 5 people per square mile should be designed for Vehicular Coverage (Light green in Figure 1).

- Rural areas with populations less than 5 people per square mile would not receive any terrestrial network coverage, but could be covered either through satellite coverage or through the use of a deployable system (White areas in Figure 1).

An image of these recommendations at the State level is provided in the figure below:

Legend
- In Building
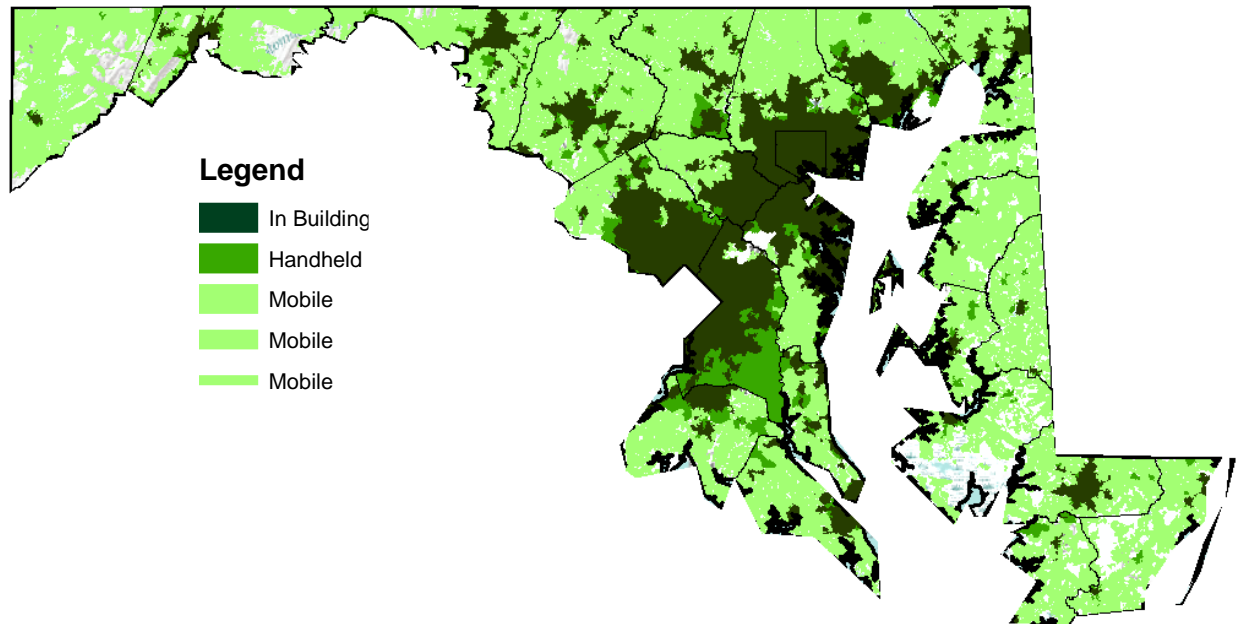- Handheld
- Mobile
- Mobile
- Mobile

Figure 1: Original OEC Coverage Recommendations

It is recognized that these baseline coverage parameters should be viewed as only initial suggestions and must be reviewed and confirmed or updated by the local responders in each area. Additionally, specific venues such as public safety facilities, large public venues, key gathering places, critical infrastructure facilities, etc. must also be taken into account.

More recently, FirstNet has proposed a new approach to coverage for the states to consider. FirstNet has generated public safety concentration area maps using a one mile by one mile grid based on the following data:

- Public safety user population;

- US population;

- Developed areas/buildings;

- Roadways (and other transportation): Includes roads and highways; commercially navigable waterways; railroads; transit links.

- Public safety high risk/areas of interest (shown in Figure 2 below – includes over 5000 points in MD);
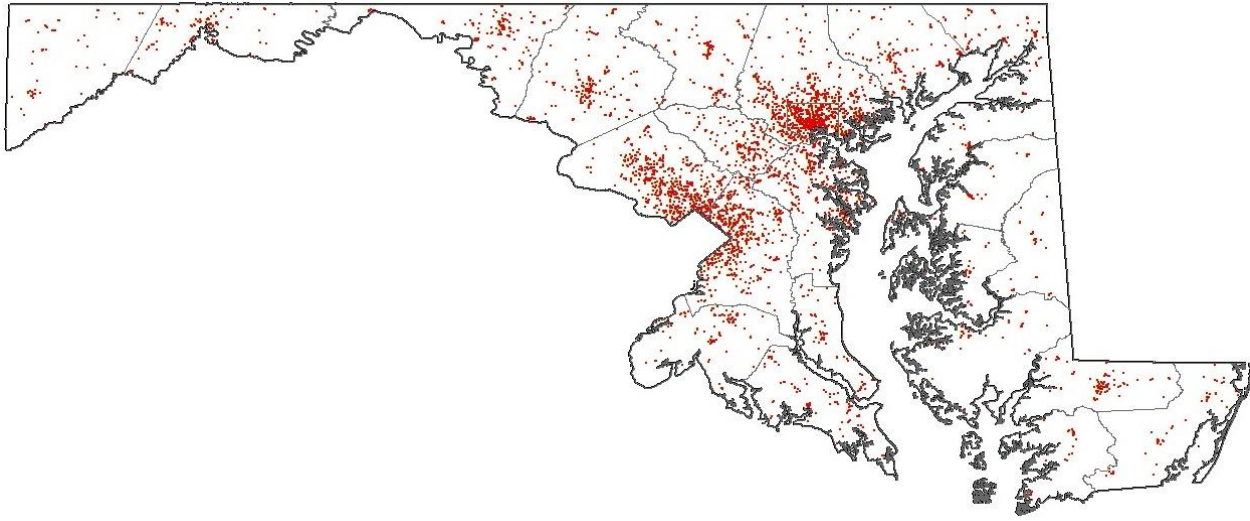
Figure 2: High Risk and Areas of Interest Points

All of the data described above was aggregated and then classified into three levels of anticipated public safety concentration. The map of the State, shown below in Figure 3, displays three different concentration levels (Low (green), Moderate (blue), and High (red)). This data will be referred to as the Public Safety Data recommendations.
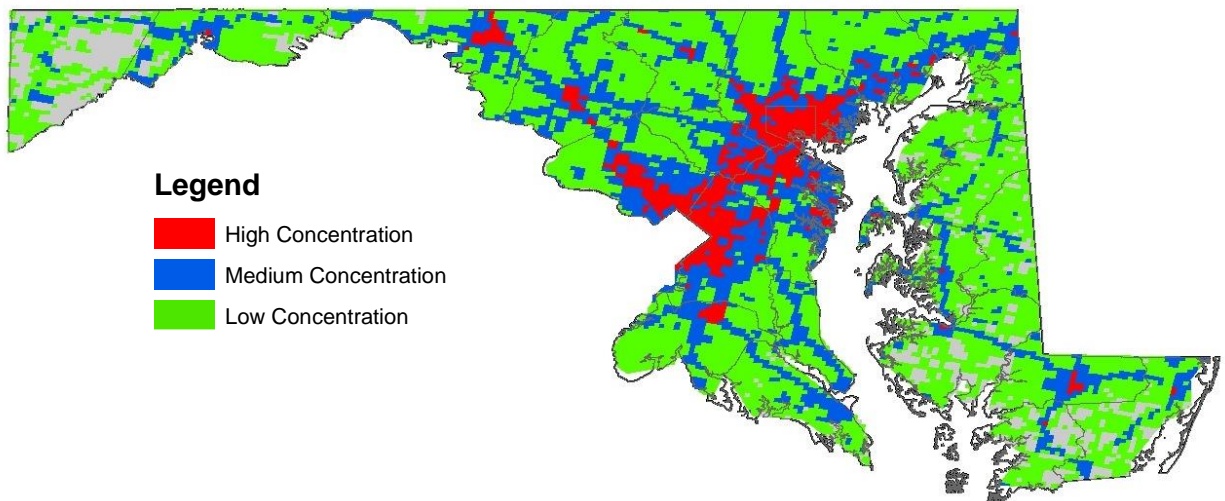

Figure 3: Coverage Recommendations based on Public Safety Data

Coverage Analysis: As part of FirstNet's data request from to the states, FirstNet has requested feedback on the methodology and baseline data used to include potential enhancements. The MD FirstNet team has analyzed the coverage recommendations provided by FirstNet in order to determine how best to respond to FirstNet's inquiries and to develop a method to evaluate coverage requirements across the entire State.

Initially, a comparison of the two different forms of coverage recommendations was performed. In the two figures below, it can be seen that differences exist between the two different recommendations. In Figure 4, the OEC recommendations (aggregated and shown as all green) are overlaid onto the Public Safety Data recommendations (aggregated and shown as all pink). It can be seen that several areas of pink can be seen through the top green layer. This indicates there are some areas recommended for public safety broadband coverage based on the Public Safety Data that were not identified in the original OEC recommendations. Conversely, Figure 5 displays the Public Safety Data recommendations (all in pink) overlaid onto the OEC recommendations (all in green). In this image, it can be seen that several areas of green can be seen through the top pink layer. This indicates there are some areas recommended for public safety broadband coverage based on the original OEC recommendations that were not identified in the Public Safety Data.
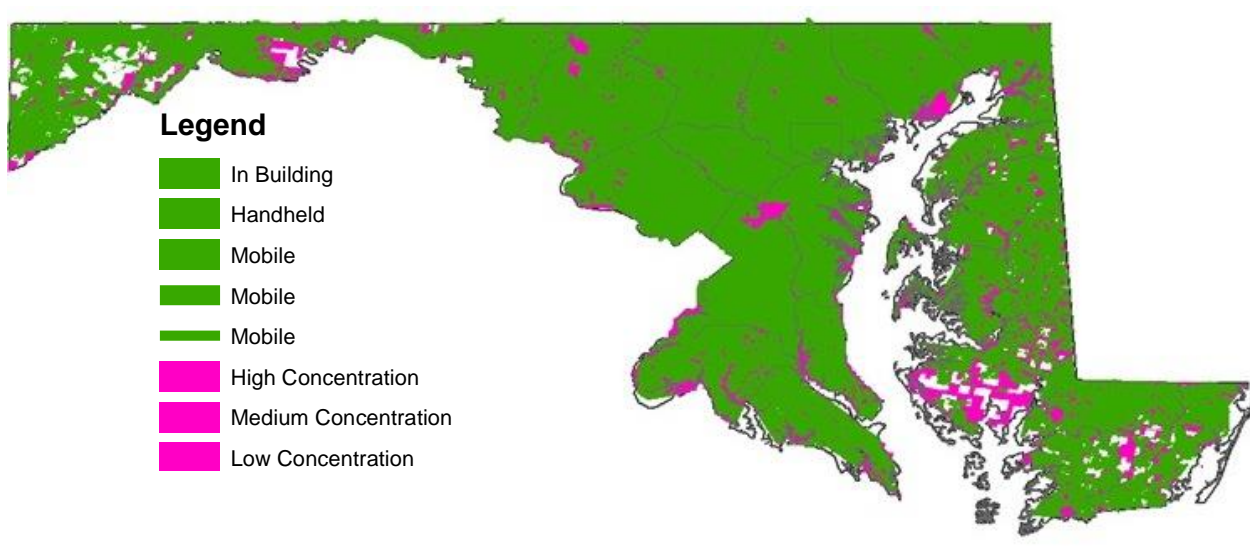

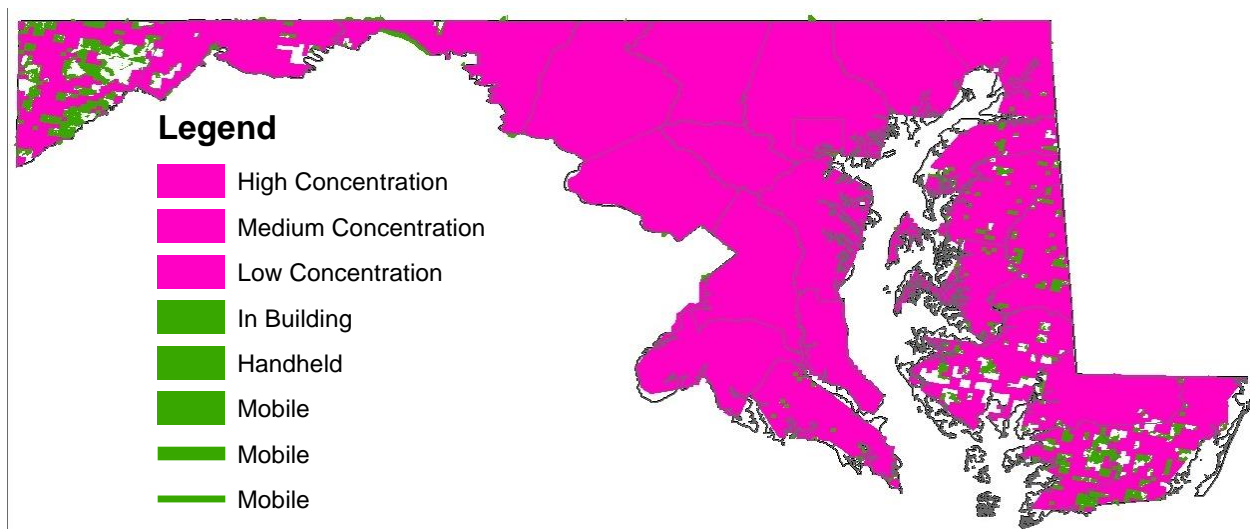Figure 4: OEC Recommendations Overlaid on Public Safety Data

Figure 5: Public Safety Data Overlaid onto OEC Recommendations

Due to the results seen in Figures 4 and 5, it can be concluded that there are some significant differences between the two coverage recommendations in some areas. Additionally, when the Public Safety Data is examined closely, it can be seen that the one-mile by one-mile grid is too course of a measurement to provide accurate recommendations, especially along the coastal areas.

Methodology: In order to ensure that all areas within the State of MD receive an accurate assessment of their public safety broadband needs, the MD FirstNet team will perform its own geographical public safety coverage evaluation on a quarter-mile by quarter-mile grid. This will be done by examining and evaluating a number of factors that suggest the need for public safety response and that indicate areas where public safety broadband coverage would be beneficial.

The factors chosen are either those that demonstrate historical public safety response, or factors that are believed to drive the need for public safety response as confirmed through discussions with public safety users in the State. The specific need factors identified are grouped by category and described below:

- Calls for Service Data

    o Historical calls for service based on Computer Aided Dispatch (CAD) data: The number of calls recorded in a grid area over the 2014 year. This data will be classified to one of 10 levels (1-10).

    o Average Call Duration: The average duration of calls for service in each grid. The duration is measured from the time of unit dispatch until the call is closed. Calls for service that are transported to a hospital will be closed at the time the unit arrives at the hospital. The duration for all

other calls will be calculated f to the close time. This data will be classified to one of 4 levels (1-4).

- o Call Priority Rank: A priority ranking will be given to the predominant call category or type of call recorded in that grid. The ranking (1-3) will be assigned with input from first responders, based on the likelihood that certain types of calls will be more data intensive.

- Population
  - o Public Safety Personnel: This number will represent the total number of public safety personnel assigned to an area. It will be derived from the survey responses and calculated based on the total number of personnel assigned to each agency distributed over the designated response area of that agency. This data will be classified to one of 3 levels (1-3).
  - o Nighttime Population: The total number of people residing in a grid based on US Census data (2010). This data will be classified to one of 10 levels (1-10).
  - o Daytime Population: This will reflect the daytime population of each grid, taking into account where people work, based the US Census American Community Survey data (2006-2010). This data will be classified to one of five levels (1-5).

- Transportation
  - o Traffic Count Data: The average number of vehicles that pass through a grid on a daily basis. This is based on Maryland's State Highway Administration Annual Average Daily Traffic report data and will be classified to one of five levels (1-5).
  - o Evacuation Route: Grids that intersect an evacuation route will have a value of 1, otherwise the value of the grid will be 0.
  - o Transportation: Grids that intersect a train, light rail, subway, or bus line will have a value of 1; otherwise the value of the grid will be 0.

- Facilities/Public Places
  - o Community Anchor Institutions: Grids that contain a critical facility, such as a school (K through 12), university (college or other post-secondary), medical/healthcare center, public safety facility, or community support government building, will be assigned a value of 1, otherwise the value of the grid will be 0.
  - o Facilities: Grids are within a set distance of a facility will have a value of 1; otherwise the value of the grid will be 0.

- - Airport (within 500 feet)

  - Energy Plant (within 2,000 feet)

  - Wastewater Treatment Plant (within 200 feet)

  - Correctional (Federal, State, and Local within 500 feet)

  o Public Places: Grids that are within as set distance of a public place will have a value of 1; otherwise the value of the grid will be 0.

    - Sports/Racing Arena

    - State/County Park

    - National Park/Federal Protected Land

    - State Fairground (within 2,000 feet)

- Other Coverage

  o Access to Commercial 4G Service: Grids that intersect a commercial wireless 4G coverage area will be assigned 0, whereas grids that do not intersect a commercial wireless 4G coverage area will be assigned 1. Commercial providers include AT&T, Sprint, T-Mobile, Verizon Wireless, and US Cellular as collected by the Maryland Broadband Mapping Initiative Areas where commercial 4G service is not available will be considered a higher need for public safety broadband.

  o Dead Zone: A dead zone is a location where broadband cannot be accessed. Maryland dead zones were collected by crowdsourcing efforts of the Maryland Broadband Mapping Initiative from 2009 to 2014. Grids that contain a broadband dead zone will be assigned 1, whereas grids that do not contain a broadband dead zone will be assigned 0. Areas where broadband cannot be access will be considered a higher need for public safety broadband.

  o MD FiRST Coverage: It is assumed that areas with portable coverage for the statewide 700MHz public safety radio system known as Maryland FiRST represent a high level of need for public safety communications. Additionally, areas with high levels of in-building MD FiRST coverage will be evaluated to determine the type of coverage necessary for public safety broadband.

The data from each Need Factor will be mapped geographically and overlaid onto a quarter-mile by quarter-mile grid throughout the State. In addition to a value to be assigned to each Need Factor described above, a weight will also be applied to each. The weight components will be based on each Need Factor's relative importance in

predicting public safety broadband need. The weights will be determined based on input from experienced public safety personnel. A total value can then be calculated for each grid by multiplying each Need Factor value with its corresponding weight component and summing them. The values for each grid will then be classified into five levels of Highest Need to Lowest Need. This process will result in a map for each county throughout the State, which displays the relative Public Safety Broadband Need areas and which can be used for establishing the coverage priorities and deployment phases.

In addition to public safety broadband need, it is also important to identify what level of coverage is required and where coverage inside buildings is needed. A metric known as Total Building Footprint will be used to determine this need. This value can be determined for each grid and then classified as Low, Medium and High. Those areas with Low total building footprint could likely be served well with vehicular broadband coverage. Those areas with Medium total building footprint would likely require handheld coverage with some level of in-building penetration. Finally, areas with a High total building footprint would be best served by a higher level of coverage with in-building penetration.

In order to take advantage of the data provided, and to develop a process for establishing the coverage requirements across the State, the following is recommended:

- The data sets described above will be used together to evaluate the coverage needs within each county. This process and data will provide justification to negotiate with FirstNet if areas of additional or improved coverage are needed. Also, it is recommended that specific coverage areas be identified for:
    a. Vehicular mounted modems (take into consideration the use of high power UEs and WiFi for additional coverage around the vehicle);
    b. Handheld units.

Phased Deployment: FirstNet has requested that the coverage requirements be established as part of a phased implementation plan, where the required coverage is deployed/built-out over time, where a minimum of five phases are recommended. A plan for establishing these phases must be identified. When establishing this plan, it is important to take into account rural coverage requirements. The broadband legislation requires "substantial rural coverage milestones as part of each phase of the construction and deployment of the network."

In the draft RFP documents FirstNet has distributed, preliminary milestones for different phases of the project are suggested. These are summarized in the table below:

Operating Capability	IOC-1	IOC-2	IOC-3	IOC-4	IOC-5	FOC
Projected Timeline	6 months after RFP award	12 months after award	24 months after award	36 months after award	48 months after award	60 months after award
Projected Band-14 (PS) Build-Out	None	15% of objectives	60% of objectives	80% of objectives	95% of objectives	100% of objectives
Projected Rural Milestones	None	15% of rural objectives	40% of rural objectives	60% of rural objectives	80% of rural objectives	100% of rural objectives

The State can use these preliminary milestones as guidance when recommending the deployment phases.

Capacity Planning and Throughput Needs: The data received from the surveys pertaining to the types and frequency of applications currently in use or planned for use will be compiled to establish the anticipated throughput needs or capacity requirements for the network. The throughput needs for both the uplink and downlink directions (in Mbps) will also be mapped on the same quarter-mile by quarter-mile grid as the Public Safety Broadband Need values and will be a key part of the data package to be provided to FirstNet which will define the complete public safety broadband needs for the State of Maryland.